§ 572.75 Lumbar spine, abdomen, and pelvis assembly and test procedure.

(a) *Lumbar spine, abdomen, and pelvis assembly.* The lumbar spine, abdomen, and pelvis consist of the part of the torso assembly designated as SA 106C 50 and 60 on drawing SA 106C 001, sheet 2, and conform to each applicable drawing listed on SA 106C 001, sheets 12 and 13.

(b) *Lumbar spine, abdomen, and pelvis assembly response requirements.* When the lumbar spine is subjected to a force continuously applied according to the test procedure set out in paragraph (c) of this section, the lumbar spine assembly shall—

(1) Flex by an amount that permits the rigid thoracic spine to rotate from the torso's initial position, as defined in (c)(3), by 40 degrees at a force level of not less that 46 pounds and not more than 52 pounds, and

(2) Straighten upon removal of the force to within 5 degrees of its initial position when the force is removed.

(c) *Lumbar spine, abdomen, and pelvis test procedure.* The test procedure for the lumbar spine, abdomen, and pelvis is as follows:

(1) Remove the dummy's head-neck assembly, arms, and lower legs, clean and dry all component surfaces, and seat the dummy upright on a seat as specified in Figure 42.

(2) Adjust the dummy by—

(i) Tightening the femur ballflange screws at each hip socket joint to 50 inch-pounds torque;

(ii) Attaching the pelvis to the seating surface by a bolt D/605 as shown in Figure 42.

(iii) Attaching the upper legs at the knee joints by the attachments shown in drawing Figure 42.

(iv) Tightening the mountings so that the pelvis-lumbar joining surface is horizontal; and

(v) Removing the head and neck, and installing a cylindrical aluminum adapter (neck adapter) of 2.0 inches diameter and 2.60 inches length as shown in Figure 42.

(3) The initial position of the dummy's torso is defined by the plane formed by the rear surfaces of the shoulders and buttocks which is three to seven degrees forward of the transverse vertical plane.

(4) Flex the thorax forward 50 degrees and then rearward as necessary to return the dummy to its initial torso position, unsupported by external means.

(5) Apply a forward pull force in the midsagittal plane at the top of the neck adapter so that when the lumbar spine flexion is 40 degrees, the applied force is perpendicular to the thoracic spine box.

(i) Apply the force at any torso deflection rate between 0.5 and 1.5 degrees per second, up to 40 degrees of flexion.

(ii) For 10 seconds, continue to apply a force sufficient to maintain 40 degrees of flexion, and record the highest applied force during the 10 second period.

(iii) Release all force as rapidly as possible, and measure the return angle 3 minutes after the release.

§ 572.76 Limbs assembly and test procedure.

(a) *Limbs assembly.* The limbs consist of the assemblies designated as SA 106C 041, SA 106C 042, SA 106C 071, and SA 106C 072, on drawing No. SA 106C 001, sheet 2, and conform to each applicable drawing listed on SA 106C 001, sheets 14 through 17.

(b) *Limbs assembly impact response requirement.* When each knee is impacted at 7.0 ±0.1 fps, according to paragraph (c) of this section, the maximum force on the femur shall not be more than 1060 pounds and not less than 780 pounds, with a duration above 400 pounds of not less than 0.8 milliseconds.

(c) *Limbs test procedure.* The test procedure for the limbs is as follows:

(1) Seat and orient the dummy without back support on a seating surface that is 11 ±0.2 inches above a horizontal (floor) surface as specified in § 572.78(c).

(i) Orient the dummy as specified in Figure 43 with the hip joint adjustment at any setting between 1g and 2g.

(ii) Place the dummy legs in a plane parallel to the dummy's midsagittal plane with the knee pivot center line perpendicular to the dummy's midsagittal plane, and with the feet flat on the horizontal (floor) surface.

(iii) Adjust the feet and lower legs until the line between the midpoint of

each knee pivot and each ankle pivot is within 2 degrees of the vertical.

(2) If necessary, reposition the dummy so that at the level one inch below the seating surface, the rearmost point of the dummy's lower legs remains not less than 3 inches and not more than 6 inches forward of the forward edge of the seat.

(3) Align the test probe specified in § 572.77(a) with the longitudinal center line of the femur force gauge, so that at impact, the probe's longitudinal center line coincides with the sensor's longitudinal center line within ±2 degrees.

(4) Impact the knee with the test probe moving horizontally and parallel to the midsagittal plane at the specified velocity.

(5) Guide the test probe during impact so that there is no significant lateral, vertical, or rotational movement.

§ 572.77 Instrumentation.

(a)(1) *Test probe.* For the head, thorax, and knee impact test, use a test probe that is rigid, of uniform density and weighs 10 pounds and 6 ounces, with a diameter of 3 inches; a length of 13.8 inches; and an impacting end that has a rigid flat right face and edge radius of 0.5 inches.

(2) The head and thorax assembly may be instrumented either with a Type A or Type B accelerometer.

(i) Type A accelerometer is defined in drawing SA 572 S1.

(ii) Type B accelerometer is defined in drawing SA 572 S2.

(b) *Head accelerometers.* (1) Install accelerometers in the head as shown in drawing SA 106C 001 sheet 1 using suitable spacers or adaptors as needed to affix them to the horizontal transverse bulkhead so that the sensitive axes of the three accelerometers intersect at the point in the midsagittal plane located 0.4 inches below the intersection of a line connecting the longitudinal center lines of the roll pins in either side of the dummy's head with the head's midsagittal plane.

(2) The head has three orthogonally mounted accelerometers aligned as follows:

(i) Align one accelerometer so that its sensitive axis is perpendicular to the horizontal bulkhead in the midsagittal plane.

(ii) Align the second accelerometer so that its sensitive axis is parallel to the horizontal bulkhead, and perpendicular to the midsagittal plane.

(iii) Align the third accelerometer so that its sensitive axis is parallel to the horizontal bulkhead in the midsagittal plane.

(iv) The seismic mass center for any of these accelerometers may be at any distance up to 0.4 inches from the axial intersection point.

(c) *Thoracic accelerometers.* (1) Install accelerometers in the thoracic assembly as shown in drawing SA 106C 001, sheet 1, using suitable spacers and adaptors to affix them to the frontal surface of the spine assembly so that the sensitive axes of the three accelerometers intersect at a point in the midsagittal plane located 0.95 inches posterior of the spine mounting surface, and 0.55 inches below the horizontal centerline of the two upper accelerometer mount attachment hole centers.

(2) The sternum-thoracic assembly has three orthogonally mounted accelerometers aligned as follows:

(i) Align one accelerometer so that its sensitive axis is parallel to the attachment surface in the midsagittal plane.

(ii) Align the second accelerometer so that its sensitive axis is parallel to the attachment surface, and perpendicular to the midsagittal plane.

(iii) Align the third accelerometer so that its sensitive axis is perpendicular to the attachment surface in the midsagittal plane.

(iv) The seismic mass center for any of these accelerometers may be at any distance up to 0.4 inches of the axial intersection point.

(d) *Femur-sensing device.* Install a force-sensing device SA 572–S10 axially in each femur shaft as shown in drawing SA 106C 072 and secure it to the femur assembly so that the distance measured between the center lines of two attachment bolts is 3.00 inches.

(e) *Limb joints.* Set the limb joints at lg, barely restraining the limb's weight when the limb is extended horizontally, and ensure that the force required to move the limb segment does not exceed 2g throughout the limb's range of motion.